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WIND RIVER AND BRIDGER BEDS IN THE HUERFANO LAKE BASIN.¹

BY HENRY FAIRFIELD OSBORN.

In 1888 Professor R. C. Hills, of Denver, announced his very important discovery of tertiary beds in the Huerfano River basin of southern Colorado. He contributed three papers to this subject in the Proceedings of the Colorado Scientific Society in 1888, 1889 and 1891, and finally divided the beds into three series, namely:

Huerfano Series (Eocene)	{	Huerfano Bed	Bridger Group	3,300.
	{	Cuchara Beds	300.
		Poison Canon Beds	} Lower Eocene (Green River Wasatch and Puerco).....	3,500.

The identification of the Huerfano Beds proper was made by means of a large collection of fragmentary fossils. The identification of the lower beds was upon stratigraphic evidence only, Professor Hill observing that they underlay conformably the upper beds. The essential features of his conclusions were as follows:

(1) That the Huerfano series of 3,300 feet are equivalent to the Bridger or middle eocene, and the Cuchara and Poison Cañon series are probably equivalent to the lower eocene.

(2) At the close of the Laramie period a great anticlinal axis arose to the east and southeast of the Wet Mountain Range and east of Spanish Peaks, forming the eastern border of the lake, extending fifty miles north and south, and from ten to twenty miles east and west.

(3) The eruption of the laccolithic Silver Mountain and Spanish Peaks was subsequent to the Upper Lake Deposits of Bridger age. Hence these deposits are found upon the slopes of Spanish Peaks.

(4) The drainage of the Huerfano Lake was to the north through the Wet Mountain Valley.

¹ Read before the American Association for the Advancement of Science at Detroit.

In May, 1897, the writer accompanied by Dr. J. L. Wortman, made a brief reconnaissance of this basin, and came to the following conclusions; differing from those reached by Professor Hills:

(1) That west of the Huerfano Cañon the variegated marls, clays, soft shales and sands aggregate only 800 to 1000 feet in thickness, are nearly horizontal in position, and constitute alone the true Huerfano Lake deposits. They may be positively divided into Upper Beds, equivalent to the Bridger. From the observations and conclusions made in the basin there are also undoubtedly Lower Beds, equivalent to the Wind River.

(2) That the so-called Cuchara and Poison Cañon Beds are unconformable with the Huerfano and are of older age, probably of Cretaceous, as partly determined by the presence of *Baculites* in the Poison Cañon section, which was selected by Professor Hills as typical.

(3) That the eastern boundary of the Huerfano Lake is partly indicated in the present cañon of the Huerfano River; that this boundary extended to the south so as to include the base of Silver Mountain toward the Cuchara Divide; that it lies from three to seven miles west of the 'anticlinal axis' described by Professor Hills, and that, therefore, the Huerfano Lake deposition did not extend as far to the east or south as the Spanish Peaks.

The geological features of these conclusions can hardly be dignified by the term "A theory of the Huerfano Lake," for they were formed during a hasty survey of this basin; while Professor Hill's results certainly deserve the deliberate consideration of a prolonged survey. In fact this basin with its volcanic disturbances and eruptions presents a fascinating problem in the geology of tertiary times. Among the Bridger forms discovered were many portions of the skeleton of *Tillotherium*, beside remains of *Hyrachyus*, *Palæosyops*, *Microsyops*, *Calamodon*, *Stypolophus* and *Pachynolophus*. This region is peculiar in the absence of *Uintatherium*. In the Lower Beds are found teeth and limb bones of *Coryphodon*, *Lambdotherium*, *Oxyæna*, *Pantolestes* and other Lower Eocene forms, probably of Wasatch age.

The writer is greatly indebted to Professor R. C. Hills for his very full information in regard to the topography of the basin, and for assistance and advice in connection with the trip.

PECULIAR ZONAL FORMATIONS OF THE GREAT PLAINS.

BY FREDERIC E. CLEMENTS.

The traveller through the sand hills of Nebraska has often brought to his notice the striking way in which nature has marked, as though for all time, the fields and groves which once dotted the country. Such areas are always most conspicuous, because of the strange contrast between their sharply marked dark green and the thin, brown vegetation of the sand hills. Frequently the waste is a flaming mass of the western sunflower, *Helianthus petiolaris*, in which case it is distinctly visible for several kilometers. In many localities, such wastes have existed for more than a score of years, and, instead of diminishing in any respect, become each year more and more accentuated.

The elevated prairies and tablelands, which are so typical of the Great Plains before the latter rise into the foot hills of the Rocky Mountains, are characterized by a floral covering monotonous in the extreme. Trees and shrubs are entirely absent, and undershrubs are present only in peculiar alkaline areas, and in "bad lands." The color-tone of the floral covering is green only for one or two spring months: after the first of June, it becomes a uniform straw color, stretching in all directions to the horizon. The two principal formations of the high plains of western Nebraska are the *Stipa comata* formation, and the peppergrass-cactus formation. Rarely, the former is traversed by a sandy zone several kilometers wide and 20-30 kilometers long, characterized by the *Artemisia filifolia* formation. An individual of *A. filifolia* regarded alone is scarcely green, but the mass of individuals, by contrast with